RESEARCH ARTICLE

Phytochemical Screening and Antibacterial Activity of Bryophytes

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ABSTRACT

In this paper we study antibacterial activity and phytochemical screening of the bryophytes. The bryophytes possess some bioactive compounds and therefore are medicinally very useful plants. They contain pools of secondary metabolites, which are unique .The antimicrobial activity was assessed using agar well diffusion method against the two bacterial strains from the bryophytes viz *Anthoceros erectus*, *Asterella angusta*, *Cyathodium tuberosum*, *Plagiochasma articulata* and *Targionia hyphophylla* the studies of phytochemical constituents revealed presence of alkaloids, flavonoids, coumarins, phenols, tannins, steroids, and sugars. The antimicrobial activity is due to the presence of secondary metabolites. It was highest in *Targionia hyphophylla* and least in *Cyathodium tuberosum*. The above observations suggest that due to significant antibacterial activity of the bryophytes they have good potential in drug development.

Keywords: Antimicrobial activity, Phytochemical screening, Bryophytes

INTRODUCTION

Bryophytes are the oldest land plants, which include liverworts, hornworts and mosses. This group of vascular plants include about 25,000 to 28,000 species and they grow in shady locations. They are herbaceous and absorb water and mineral nutrients mainly through leaves. They have an interesting feature, which is about not getting attacked by bacteria, fungi or pests. They are potential source of medicine as they contain secondary metabolites. The antibiotic properties are due to the biologically active compounds. Bryophytes are a rich reservoir of biological active compounds such as terpenoids, flavonoids, alkaloids, glycosides, saponins, anthroquinons, sterols and other aromatic compounds. They also possess anticancer and antimicrobial activity due to their unique chemical constituents. In the present investigation the bryophytes were screened for their antibacterial activities and phytochemical constituents. In this paper we study antibacterial activity and phytochemical screening of the bryophytes. This study would enable investigation of the use of bryophytes in drug development.

MATERIAL AND METHODS

The bryophytes viz *Anthoceros erectus*, *Asterella angusta*, *Cyathodium tuberosum*, *Plagiochasma articulate* and *Targionia hyphophylla*, were collected from Lonavla.

Plant extraction: The plant material was carefully picked from the soil and washed thoroughly with distilled water to remove the adhering soil or extraneous dust particles. A quantity of 50 gm air dried plant material along with rhizoids was powered in mortar with pestle extracted in methanol and ethanol. These extracts were used for further studies.

Test microorganisms: The bacterial strains were procured from NCIM, NCL, Pune. In vitro antibacterial activity was tested against Staphylococcus aureus and Bacillus subtilis.

Determination of antimicrobial activity: Plant extracts were tested for antibacterial activity through agar-plate diffusion method using 100 µl of suspension of the test microorganisms. Bacterial strains were grown on nutrient agar plates. Sterile nutrient agar plates were prepared, and 48 hours cultured suspensions were made and inoculated on sterile agar medium in the respective culture plates. The 10 mm sterile cork borer was used for making wells. The extracts, 0.1 and 0.2 ml were added in assay well carefully. A quantity of 50 µg ml–1 tetracycline and ampicillin (Hi-Media), which served as +ve control methanol and ethanol (Hi-Media), was used as –ve control were added in the wells. All the plates were kept at low temperature for 1-1½ hrs for sample diffusion and incubated at 35°C for 48 hrs. After incubation, the zone of inhibition was measured.

Statistical analysis: Statistical analysis was done using one-way analysis of variance (ANOVA). The quantity $P < 0.05$ was considered significant.

Phytochemical screening: The aqueous extracts of all the selected bryophytes were subjected to various phytochemical tests to detect the presence of certain bioactive compounds (Trease, 2002).

RESULTS

The antibacterial activity has been depicted in Fig. 1. The results reveal that the bryophytes *Asterella angusta* had greater antibacterial activity in methanol extract and in *Targionia hyphophylla* and *Plagiochasma articulata* the antibacterial activity was greater in ethanol extract. In *Anthoceros erectus* the antibacterial activity of both methanol and ethanol was less and least in *Cyathodium tuberosum* The phytochemical screening is depicted in Table 1. It indicated the presence of secondary metabolites like alkaloids, phenols, tannins, flavonoids, coumarins, steroids, and sugars; whereas carboxylic acid, resins, saponins were not present.

Table 1: Phytochemical analysis of selected bryophytes

Phytochemical constituents	*Anthoceros erectus*	*Asterella angusta*	*Cyathodium tuberosum*	*Plagiochasma articulata*	*Targionia hyphophylla*
Alkaloids	+	+	-	-	+
Carboxylic acids	-	-	-	-	-
Coumarins	+	+	-	+	+
Flavonoids	+	+	-	+	+
Phenols	+	+	+	+	+
Resins	-	-	-	-	-
Saponins	-	-	-	-	-
Steroids	+	-	-	+	+
Tanins	-	-	-	+	+
Sugars	+	+	+	+	+

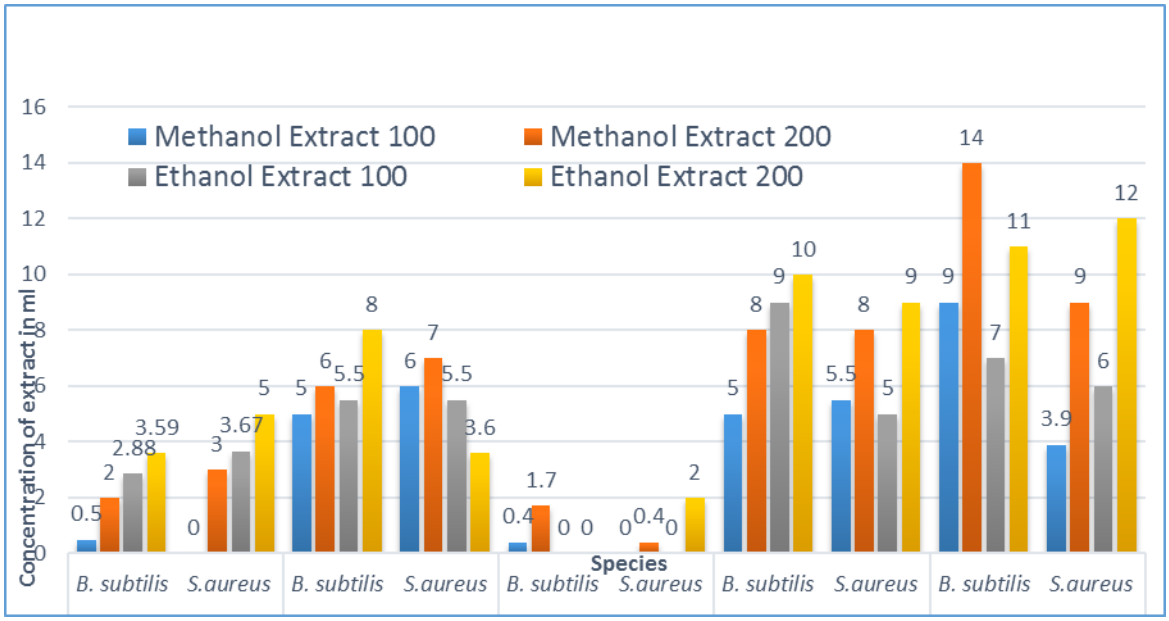

Fig. 1: Antibacterial activity of methanol and ethanol extracts of some bryophytes

DISCUSSION

The present study reports that there is varying level of activity in the test species. This suggests that the extracts in both the solvents have a broad spectrum activity, hence there is a need to investigate further for their use as for antibacterial agents, which could help in new drug development (Sawant *et al*., 2010). The antimicrobial activity carried out by Oyesiku and Caleb (2015) in three mosses also reveal that ethanol extract was found to be more active than the other two and are of the opinion that these extracts show antibiotic activity. This suggests that specific antibacterial compounds isolated by ethanol are more effective against specific bacteria. Deora and Rathore (2013) have revealed that *Plagiochasma articulata* crude extract adversely affected the bacterial growth.

Bodade *et al*. (2008) also have observed that the ethanolic extract was more active than other fractioned extracts and *Plagiochasma articulata* was most active against bacteria and fungi. They are of the opinion that antimicrobial activity may be due to secondary metabolites. Similar observations have been made by Nikolajeva *et al*. (2012) in different bryophytes. They have found that 73% ethanolic extracts exhibited antibacterial activity and it was also higher as compared with aqueous extracts. Studies carried out by Singh *et al*. (2011) also reveal that all the four different bryophyte, namely, *Plagiochasma appendiculatum*, *Conocephalum coricum*, *Mnium marginatum*, and *Byrum argenteum* have antibacterial activity and their findings support the use of bryophytes in traditional medicine for treating burn infections.

The results of the phytochemical screening reveals that the phytochemical compounds may be responsible for antimicrobial activity of the bryophytes and they are alkaloids, flavonoids, quinones, resins, steroids, tanins and sugars. Batish *et al*. (1997), Ahmed *et al*. (1998), and Kumaraswamy and Satish (2008) are of the opinion that the activity may be due to presence of various secondary metabolites. Deora (2015) has observed that selected bryophytes showed the presence of terepenoids, flavonoids, steroids, and glycosides were present whereas, whereas alkaloids, saponins and anthroquinons were not present and have further stated that these chemical compounds could be potent antimicrobial agents to treat plant diseases.

CONCLUSION

In this research work the antimicrobial activity in bryophytes was assessed using agar well diffusion method against the two bacterial strains. The bryophytes considered were *Anthoceros erectus*, *Asterella angusta*, *Cyathodium tuberosum*,

Plagiochasma articulata and *Targionia hyphophylla.* The studies of phytochemical constituents revealed presence of alkaloids, flavonoids, coumarins, phenols, tannins, steroids, and sugars in the selected bryophytes. The antimicrobial activity is due to the presence of secondary metabolites. It was observed to be highest in *Targionia hyphophylla* and least in *Cyathodium tuberosum*. The research study suggests that due to significant antibacterial activity observed in the bryophytes they have good potential in drug development.

Conflicts of interest: The authors stated that no conflicts of interest.

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